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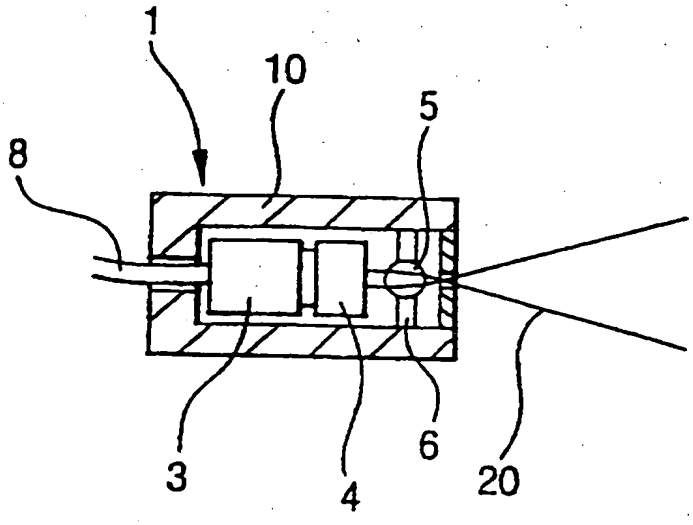
(54) Abstract Title
Optical device for forklift

(57) There is described a forklift provided with an optical device fitted to its forks (15, Fig. 4). The optical device aids the forklift operator in aligning the forks with a pallet (17, Fig. 3) which is to be lifted. The optical device 1 includes a laser light source 4 and a lens 5 positioned in the path of the laser beam, to expand the beam. In one embodiment a cylindrical concave or convex lens may be used, producing a beam which diverges only in the plane of the forks. When projected on the pallet, such a beam is viewed as a horizontal line of light (20a, Fig. 3). In an alternative embodiment a cross shaped lens (50, Fig. 6) may be used to produce a beam which diverges in two mutually perpendicular planes, producing two perpendicular lines of light when projected on the pallet. The lens may be detachable from the optical device 1. With the lens removed a spot of light is projected on the pallet.

FIG. 1



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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FIG. 5

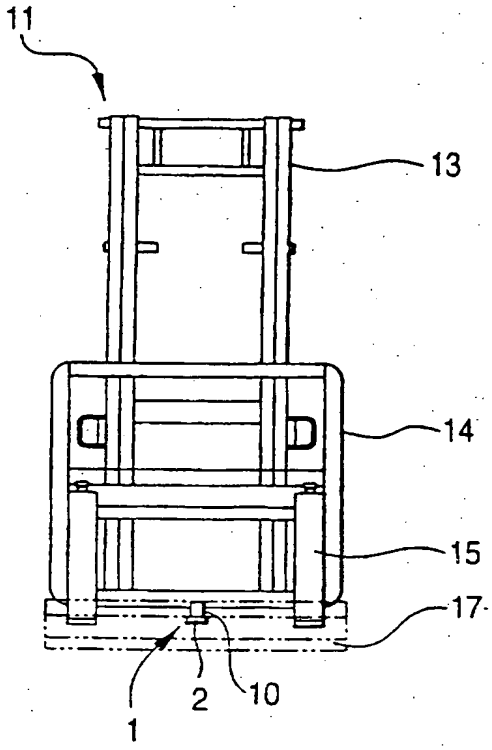


FIG. 6A

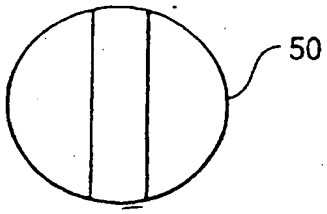


FIG. 6B

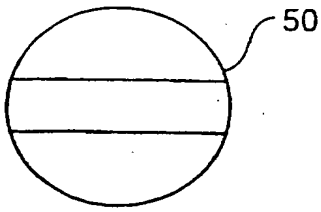


FIG. 6C

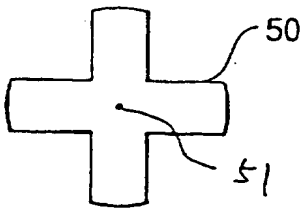


FIG. 6D

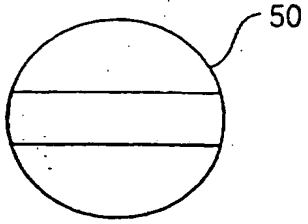


FIG. 6E

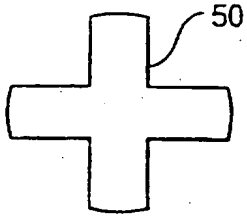
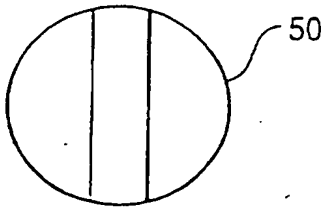


FIG. 6F



FORKLIFT

The present invention relates to a load position indicating device for a forklift and in particular to a forklift which, when a load is to be loaded on a pallet or a rack, the pallet or the like is illuminated with a laser beam so that its position is visually recognised.

In a conventional forklift using a laser light source, as shown in Fig. 2, a light spot projected onto a pallet 17 has a spot-like shape.

As described above, in an optical pallet detecting device using a laser light source conventionally, a light spot projected onto the pallet 17 has a spot-like shape. As shown in Fig. 2, when the light beam impinges on an insertion hole 17a of the pallet 17, therefore, a light spot 18a is not formed as indicated by a chain line 18b. When the light beam impinges on a gap between adjacent loads 19, a light spot 23a is not formed as indicated by a chain line 23b. As a result, there arises a problem in that sight of the impinging position can be lost.

According to the present invention, there is provided a forklift comprising:-

a main body;

a forklift movable in a vertical direction relative to the main body for lifting a load; and

a light source mounted on the forklift, wherein the light source is operative to emit a diverging light beam to illuminate an area in front of the forklift.

The light source preferably emits a beam that diverges laterally. The beam may be in the shape of a cross.

According to an embodiment of the invention, the problem is solved by a forklift in which a mast upstands in front of a body of the forklift, a lift bracket is mounted on the mast in a vertically movable manner, and a fork is engaged with the lift bracket, wherein a laser light source which illuminates an area in front of the fork is attached to the lift bracket or the fork, and a light beam emitted from the laser light source is formed into a shape which laterally elongates, via a lens.

Fig. 1 is a plan sectional view of an optical pallet detecting device for use in a forklift embodying the invention;

Fig. 2 shows light spots formed on a pallet face by an optical pallet detecting device of the conventional art;

Fig. 3 shows how light spots are formed in a pallet face by an optical pallet detecting device employed in a forklift embodying the present invention;

Fig. 4 is a side view showing a forklift embodying the present invention;

Fig. 5 is a front view illustrating an attachment state on a lift bracket; and

Each of Figs. 6A to 6F show a lens having a sectional cross shape, in which Fig. 6A is a top side view of the lens; Fig. 6B is a left side view of the lens; Fig. 6C is a front side view of the lens; Fig. 6D is a right side view of the lens; Fig. 6E is a back side view of the lens; and Fig. 6F is a bottom side view of the lens.

When a light beam is emitted toward a pallet from a laser light source which is attached to a lift bracket or a fork so as to illuminate tines of the fork, the light beam which is expanded by the lens into a fan-like shape in a plan view impinges on the pallet. Consequently, as shown in Fig. 3, a linear light spot 20a is formed which extends over right and left ends and a centre beam portion which co-operate to form fork insertion openings 17a between a deckboard and an edgeboard.

The description will be described in detail with reference to the accompanying drawings. Firstly, an optical pallet detecting device will be described with reference to Fig. 1. An optical pallet detecting device 1 comprises a connector 3 which is connected to an electric energy source via an electric wire 8, a laser light source 4, a lens 5, and a lens fixing member 6. These components are fixed to the inside of a hollow cylinder 10.

The lens 5 has a cylindrical shape having the centre axis which elongates in the direction perpendicular to the sheet in Fig. 1. A linear light beam emitted from the laser light source 4 is refracted by the cylindrical lens 5 to be expanded into a fan-like shape in a plan view as shown in Fig. 1, i.e. a shape which laterally elongates in a horizontal plane in the illumination plane. Since the lens 5 has a cylindrical shape, the light is not vertically expanded.

An example in which the device is mounted on a forklift will be described with reference to Fig. 4 which is a side view. The forklift 11 comprises the body 12, a mast 13, a lift bracket 14 and a fork 15. The lift bracket 14 is vertically moved, and, in accordance with this movement, the fork 15 is vertically moved.

The optical pallet detecting device 1 is attached to the lift bracket 14, at a position where the device can perform illumination along the same plan as the tines of the fork and on a straight line.

According to this configuration, as shown in Fig. 3, the laser light emitted from the detecting device 1 forms a light spot having a predetermined length in the direction of a horizontal plane or a direction parallel to a pallet. When the light spot impinges on a pallet, the light spot has a shape which laterally elongates, as indicated by 20a, so that a wide range including the insertion openings 17a of the pallet 17 is irradiated. When the light spot impinges on a load 19 placed on the pallet 17, the load 19 can be surely irradiated regardless of the placement position of the load 19, as indicated by 22a.

As described above, the optical pallet detecting device 1 is attached to the position where the device can perform illumination along the same plane as the tines of the fork and on a straight line. When the forklift 11 is advanced, after the light spot is formed as indicated by 20a in Fig. 3, the fork 15 can be surely inserted into the insertion openings 17a of the pallet 17.

When the lens 5 is configured so as to be detachable from the cylinder 10, the light spot of the laser light can be changed so as to be formed into a spot-like shape in the same manner as the conventional art described above, thereby enabling the device to be used more conveniently.

While the lens 5 is a cylindrical convex lens, a cylindrical concave lens may be used in place of the cylindrical convex lens 5 so as to expand the laser light in one direction.

In addition, as shown in Figs. 6A to 6F, a lens 50 may be used in place of the lens 5. Each of Figs. 6A to 6F shows the lens 50 in view from each of six different directions three-dimensionally perpendicular to each other. Fig. 6C and 6E are a front side view and a back side view of the lens 50 respectively. In Fig. 6C, a reference numeral 51 denotes a centre of the cross on the lens surface. The lens 50 is formed in such a manner that a lens having a spherical body is cut to be in section in the shape of the cross, so that the lens 50 is seen in the shape of the cross when looking at the lens 50 from the front side direction or the back side direction.

In the case of the lens 50, as shown in Fig. 6C, the centre 51 of the cross of the lens 50 is illuminated with a beam of the laser light from the front side direction from which the lens 50 is seen in the shape of the cross. The lens refracts the laser light so as to expand the laser light in accordance with the shape of the lens 50. Thereafter, the laser light is emitted outside of the lens 50 to illuminate the pallet 17. A shape of the laser light illuminating the pallet 17 is a cross.

Accordingly, in the case where a user uses an optical pallet detecting device having the lens 50, the user can understand a position of the fork 15 in the vertical direction from a horizontal line of the cross shape of the laser light illuminating the pallet 17. Moreover, the user can understand the position of the fork 15 in the horizontal direction from a vertical line of the cross shape of the laser light illuminating the pallet 17. As a result, the position of the fork

can be simultaneously understood in the vertical direction and the horizontal direction by using the lens 50.

Because the shape of the illuminated cross of the laser light has a certain degree of length in the horizontal direction and the vertical direction, if the centre of the cross has a little gap from the pallet, the user can easily adjust the centre of the cross to the desirable position without missing the illuminated position of the laser light.

As mentioned above, the lens 50 may be configured so as to be detachable from the cylinder 10, so that the light spot of the laser light can be changed so as to be formed into a spot-like shape or a line shape according to each situation, thereby enabling the device to be used more conveniently.

In embodiments of the invention, as described above, the light beam emitted from the laser light source is formed into a lateral shape which elongates in the width direction of a pallet. The light spot 20 is surely formed in a gap between a load and another load 9, the insertion openings of the pallet 17 and the like. Namely, the light spot 20a which laterally elongates is always formed. As a result, the invention attains an effect that the operator is prevented from losing sight of the light spot 20a and hence loading and unloading works can be smoothly conducted.

CLAIMS

1. A forklift comprising:-

a main body;

a forklift movable in a vertical direction relative to the main body for lifting a load; and

a light source mounted on the forklift, wherein the light source is operative to emit a diverging light beam to illuminate an area in front of the forklift.

2. A forklift in accordance to claim 1, wherein the light source is operative for emitting a light beam which laterally diverges.

3. A forklift according to claim 1, wherein the light source is operative for emitting a light beam which diverges in the shape of a cross.

4. A forklift according to any one of the preceding claims wherein the light source is a laser light source.

5. A forklift comprising:-

a main body;

a mast disposed in front of the main body;

a lift bracket mounted on the mast, the lift movable in vertical;

a fork engaged with the lift bracket;

a laser light source disposed on the lift bracket or said fork, for illuminating an area in front of said fork; and

a lens disposed in front of the laser light source, wherein a light beam emitted from said laser light source via the lens is formed into a shape which laterally elongates.

6. The forklift as claimed in claim 1 wherein the lens has a cylindrical shape having the centre axis in parallel to the horizontal direction and perpendicular to the light propagation direction.

7. A forklift comprising:-

a main body;

a mast disposed in front of the main body;

a lift bracket mounted on the mast, the lift movable in vertical;

a fork engaged with the lift bracket;

a laser light source disposed on the lift bracket or said fork, for illuminating an area in front of said fork; and

a lens disposed in front of the laser light source, wherein a light beam emitted from said laser light source via the lens is formed into a cross shape.

8. The forklift as claimed in claim 3, wherein the lens has a cross shape in a view from a direction, the laser light illuminates a centre of the cross shape of the lens.

9. A forklift substantially as hereinbefore described with reference to Fig. 1 or Fig. 4 or Fig. 5 or Figs. 1 and 6a to 6f of the accompanying drawings.